WHAT IS CLAIMED IS: SEARCH

1. A method for communicating information over a SONET line switched ring having a plurality (K) of communication terminals connected to a first and a second transmission line, comprising the steps of:

at each terminal (k), inserting an outgoing signal onto said first transmission line along a first direction of transmission defined from said terminal (k), towards an adjacent terminal (k+1), wherein (k) is an integer between 1 and (K) giving the sequential position of said node (k) in said ring;

at each said terminal (k), receiving an incoming signal over said first transmission line from an adjacent terminal (k-1), along said first direction of transmission; and

operating said plurality of communication terminals according to a unidirectional protection protocol upon detection of a failure condition in said incoming signal.

2. A method as claimed in claim 1, wherein said incoming signal is an incoming asynchronous transfer mode (ATM) STS-Mc and said outgoing signal is an outgoing ATM STS-Mc.

3. A method as claimed in claim 1, wherein said incoming signal is an incoming STS-N comprising an incoming non-ATM STS-W and an incoming ATM STS-Mc and said outgoing signal is an outgoing STS-N comprising an outgoing non-ATM STS-W and an outgoing ATM STS-Mc, wherein M+W=N.

4. A method as claimed in claim 3, wherein each of said incoming and outgoing STM STS-W comprises a plurality of virtual tributaries (VT).

5. A method as claimed in claim 2, wherein said unidirectional protocol operates according to a variant of BellCore GR-1230-CORE standard, comprising unmodified assignments for all bytes of the transport overhead (TOH) field of said incoming signal, but:

a modified assignment of bits 0-4 of the K1 byte, wherein the span code (LP-S, SF-P) is used for a lockout of protection code (LP-P), span code FS-S is used for a signal fail on protection code (SF-P), span codes (SF-S), (SD-S), (MS-S) and EX-S), and reverse request codes (RR-S) and (RR-P) are eliminated; and

a modified assignment of bits 6-8 of the K2 byte, wherein the code "Bridges and Switched" is sued for a code "Switched".

6. A method as claimed in claim 3, wherein said unidirectional protection protocol operates according to BellCore GR-1230-CORE standard for said incoming and outgoing non-ATM STS-W and according to a variant of BellCore GR-1400-CORE standard for said incoming and outgoing ATM STS-Mc, said variant comprising unmodified assignments for all bytes of the transport overhead (TOH) filed of said incoming signal, but:

a modified assignment of bits 0-4 of the K1 byte, wherein the span code (LP-S, SF-P) is used for a lockout of protection code (LP-P), span code FS-S is used for a signal fail on protection code (SF-P), span codes (SF-S), (SD-S), (MS-S) and EX-S), and reverse request codes (RR-S) and (RR-P) are eliminated; and

a modified assignment of bits 6-8 of the K2 byte, wherein the code "Bridges and Switched" is sued for a code "Switched".

7. A method for transporting a SONET formatted asynchronous transfer mode (ATM) signal on a unidirectional line switched ring comprising the steps of:

connecting a plurality (K) of nodes in a ring network provided with a working transmission line associated with a first direction of transmission and a protection transmission line associated with a second direction of transmission, opposite to said first direction;

detecting at a node (k) an error signal received from a node (k-1) located adjacent to said node (k) and upstream with respect to said first direction;

at said node (k), generating a status change request upon receipt of said error signal, and transmitting said status change request on said working and protection transmission line; and

restructuring all said nodes of said ring to operate according to one of a working transmission line failure (WTLF), a node failure (NF), a protection transmission line failure (PTLF), and a working and protection transmission line failure (WPTLF) configuration, upon receipt of said status change request.

8. A method as claimed in claim 7, further comprising the step of restructuring all said nodes of said ring for operation in an idle state upon receipt of a ring recovery request.

9. A method as claimed in claim 7, wherein said error signal indicates one of a lost connection (SF) and a degraded connection (SD).

10. A method as claimed in claim 8, wherein said ATM traffic comprises one of an STS-Mc and a plurality (M) of STS-1s.

11. A method as claimed in claim 10, wherein said error signal, said status change request and ring recovery request signals are transported around said ring in the K-bytes of the transport overhead (TOH) of said STS-Mc.

12. A method as claimed in claim 7, wherein said step of restructuring all nodes into said WTLF configuration comprises:

remodelling said node (k) to assume a switched state;

remodelling said node (k-1) to assume a bridged state; and

remodelling all remaining nodes (p), where $p \neq k, k-1$, to assume a passthrough state.

13. A method as claimed in claim 12, wherein said node (k) in said switched state performs the operations of:

receiving an incoming ATM STS-Mc from said protection transmission line;

determining the address ~~of a destination~~ node (q) for said incoming ATM STS-Mc,

routing said incoming ATM STS-Mc from said protection transmission line onto said working transmission line if said destination node (q) is not said node (k);

extracting said incoming ATM STS-Mc from said protection fiber if said destination node (q) is said node (k); and

inserting an outgoing STS-Mc originating at said node (k) into said working transmission line.

14. A method as claimed in claim 12, wherein a node (p) in said passthrough state performs the operations of:

receiving an incoming ATM STS-Mc from said working transmission line;

determining the address of a destination node (q) for said incoming ATM STS-Mc;

extracting said incoming ATM STS-Mc from said working transmission line, if said destination node (q) is same as said node (p);

routing any traffic received on said protection transmission line back onto said protection transmission line if said destination node (q) is not said node (p); and

inserting an outgoing STS-Mc originating at said node (p) onto said working transmission line.

15. A method as claimed in claim 12, wherein said node (k-1) in said bridges state performs the operations of:

receiving an incoming ATM STS-Mc on said working transmission line;

determining the address of a destination node (q) for said incoming ATM STS-Mc;

extracting said incoming ATM STS-Mc from said working transmission line if said destination node (q) is same as said node (k-1);

routing said incoming ATM STS-Mc from said working transmission line onto said protection transmission line if said destination node (q) is not said node (k-1); and

inserting an outgoing STS-Mc originating at said node (k-1) onto said protection transmission line.

16. A method as claimed in claim 12, further comprising the steps of:

identifying at said node (k) if said status change request indicates a NF error and determining the address of a failed node;

receiving an incoming ATM STS-Mc and determining the address of a destination node (q) for said incoming ATM STS-Mc; and

discarding incoming ATM STS-Mc if the address of said destination node (q) is the same as the address of said failed node.

17. A method for communicating information on a bidirectional line switched ring (BLSR) configuration including a plurality (K) of ring nodes connected by a first and a second transmission line, comprising the steps of:

deploying said BLSR in a homing-type configuration, each node (k) having an incoming path associated with a node drop direction and an outgoing path associated with a node add direction:

at a first node (q), where $q \neq k$, of said BLSR, transmitting a first SONET formatted signal along said first transmission line, said first SONET formatted signal having a bandwidth $K \times BW$;

at each node (k), where $k \neq q$, of said BLSR, receiving said first SONET formatted signal from said first transmission line, extracting same over a respective incoming path, and re-transmitting said first SONET formatted signal over a respective outgoing path back into said first transmission line;

at each said node (k), inserting a respective outgoing SONET formatted signal into said second transmission line over said respective outgoing path, each outgoing SONET formatted signal comprising traffic formatted at a respective node (k), and having a bandwidth BW; and

at each said node (k), extracting a respective incoming SONET formatted signal received from said second transmission line over said respective incoming path, each incoming SONET formatted signal comprising traffic addressed to said respective node (k), and having said bandwidth BW.

18. A node for a SONET line switched ring comprising:

a first ring interface with a first working port for receiving an incoming optical signal OC-Mc from a working transmission line associated with a first direction of transmission, and converting same into an incoming STS-Mc;

a second ring interface with a second working port for converting an outgoing STS-Mc into an outgoing optical signal OC-Mc and transmitting same over said working fiber;

an ATM cell management block for routing an output ATM cell extracted from said incoming STS-Mc as one of a drop ATM cell and a passthrough ATM cell, and multiplexing said passthrough ATM cell and an add ATM cell into said outgoing STS-Mc; and

an STS management block for routing said incoming STS-Mc between said first ring interface and said ATM cell management block, and said outgoing STS-Mc between said ATM cell management block and said second ring interface.

19. A node as claimed in claim 18, further comprising:

a first protection port at said second interface, connected to a protection transmission line associated with a second direction of transmission opposed to said first direction of transmission;

a second protection port at said first interface connected to said protection transmission line; and

an STS protection controller for detecting an error signal in said incoming STS-Mc and instructing said STS management block to configure said first and second ring interfaces to route said incoming STS-Mc and said outgoing STS-Mc in conformity with a unidirectional line switched protection protocol (ULSPP).

20. A node as claimed in claim 18, wherein said ATM cell management unit comprises:

a STS management interface for receiving said incoming ATM signal and delineating therefrom said drop and said passthrough ATM cells and for receiving said add ATM cell and multiplexing same into said outgoing ATM signal;

a cell control unit for routing said add, drop and passthrough ATM cells to one of said ATM trib interface and said STS management interface, according to a respective virtual path identifier (VPI);

an ATM trib interface for receiving said drop ATM cell and routing same to an ATM trib port, and for receiving said add cell from said ATM trib port and routing same to said cell control unit;

a first routing table for storing the VPI of said drop ATM cell and passthrough ATM cell; and

a second routing table for storing the VPI of said add ATM cell.

21. A node for a SONET line switched ring comprising:

a first ring interface with a first working port for receiving a SONET formatted incoming optical signal from a working transmission line associated with a first direction of transmission, and converting same into an incoming non-ATM signal and an incoming ATM signal;

a second ring interface with a second working port for converting an outgoing non-ATM signal and an outgoing ATM signal into an outgoing SONET formatted optical signal and transmitting same over said working transmission line;

an ATM cell management block for processing and transmitting an output ATM cell extracted from said incoming ATM signal as one of a drop ATM cell and a passthrough ATM cell, and multiplexing said passthrough ATM cell and an add ATM cell into said outgoing ATM signal;

an STS management block for routing said incoming non-ATM signals as one of an output non-ATM signal and a passthrough non-ATM signal, routing said passthrough non-ATM signal and an input non-ATM signal as said outgoing non-ATM signal and routing said incoming and outgoing ATM signals between said first and said second ring interfaces and said ATM cell management block; and

a non-ATM payload management for processing and transmitting said output non-ATM signal to a non-ATM port, and for processing and transmitting said outgoing non-ATM signal to said STS management block.

22. A node as claimed in claim 21, further comprising:

a first protection port at said second interface, connected to a protection transmission line associated with a second direction of transmission opposed to said first direction of transmission;

a second protection port at said first interface connected to said protection transmission line;

an STS protection controller for detecting an error signal in said incoming ATM signal and said incoming non-ARTM signal, and for instructing said STS management block to configure said first and second interfaces to route said incoming and said outgoing ATM signals in conformity with a unidirectional line switched protection protocol (ULSPP), and to route said incoming and outgoing non-ATM signals in conformity with an unidirectional path switched protection protocol (UPSPP); and

a non-ATM protection controller for detecting a further error signal in said output and input non-ATM signals and instructing said non-ATM payload management to route said output and input non-ATM signals between said STS management block and said non-ATM port according to said UPSPP.